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Melissa L. Sweat, Andrew S. Parker, Stephen P. Beaudoin

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# Compressive Behavior of High Viscosity Granular Systems: Effects of Viscosity and Strain Rate

Melissa L. Sweat<sup>a</sup>, Andrew S. Parker<sup>a</sup>, Stephen P. Beaudoin<sup>a,1</sup>

*<sup>a</sup>School of Chemical Engineering, Purdue University, 480 Stadium Mall Drive, West Lafayette, IN 47907*

## 1. Introduction

A wide variety of industries makes use of granulation processes – from pharmaceuticals and foods to minerals processing and agriculture [1,2]. Granulation can be considered the agglomeration of powder by a liquid binder [1–8]. The binder may be polymeric, where polymers are often used to hold particles together [1,2,6]. Granulation is often considered the result of three processes: nucleation and binder distribution; consolidation and growth; and attrition and breakage [1–3,5–7,9–13]. For the purposes of the research presented here, attrition and breakage of pre-formed agglomerates is of interest, with a goal of addressing the lack of detailed understanding of this unique mechanism [1,5,12,14]. Generally, breakage refers to wet granules, while attrition is associated with dry granules [13]. The primary failure modes in wet granulation are plastic and brittle [9]. When plastic failure occurs, the material may deform with no major crack formation and no peak stress development during stress-strain analysis [9,15]. The material may be described as flowing like a paste or smearing [9,13,15]. Brittle failure occurs after a major crack forms; a peak flow stress will clearly be present [9,15]. In either scenario, the deformation or failure is not recoverable [9,16].

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<sup>1</sup> Corresponding author. Current address: School of Chemical Engineering, Purdue University, 480 Stadium Mall Drive, West Lafayette, IN 47907-2100 USA. Tel.: +1 765 494 7944; Fax: +1 765 494 0805; Email: [sbeaudoi@purdue.edu](mailto:sbeaudoi@purdue.edu) (S. Beaudoin).

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